Scientific Approach and Methodology of a New In-Depth-Investigation Study in Germany so called GIDAS

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Abstract

The value of on scene in-depth accident research studies has been recognized internationally and many countries worldwide have such teams. Since such detailed information is essential for improving the safety of cars, a strong collaboration with automakers developed. This resulted in Germany in a joint project between FAT (Forschungsvereinigung Automobiltechnik or Automotive Industry Research Association) and BASt (Bundesanstalt für Straßenwesen or the Federal Road Research Institute) started on July 1999, so called "GIDAS" (**G**erman **I**n **D**epth investigation **A**ccident **S**tudy). The paper is describing the methodology of this project with statistically orientated procedure of data sampling.
The paper will describe the process of accident sampling in using a random sampling plan, weighting factors and time selection windows for getting a representative sample. All kind of traffic accidents with injury outcomes are focused with this Study, the investigation areas are Hanover and Dresden in Germany. The team consists of technicians and medical staffs. A specific photography interactive digital system is used for true to scale plans of the accident scenery. Crash information e.g. driving and collision speed, Delta-v have to be determine from traces on the scene as well as examine deformation pattern for the assessment of energy speed absorption EES. Different calculations are used by the experts. The possible ways for such calculations for scientific purposes of in-depth investigation teams are also shown in the paper.
Further on in this study the benefit of such comprehensive in-depth-investigation will be shown for an example on the analysis of multiple collisions of cars by correlation of technical parameters with injury outcome on the characteristics of injury pattern.

INTRODUCTION

As in many industrial countries also in Germany, accident trends are presented annually based on the official national accident statistics. These accident statistics use the data from police accident reports. Although these statistics are useful, a limitation is that very little information about how accidents occur, the cause of the accident and the injury mechanisms is available. This limitation can be overcome by carrying out specialist in-depth accident investigations, collecting more detailed information than available in the police records. Such investigations begin immediately after the accident occurs. Specialist teams go directly to the scene of the accident to collect the necessary information to complete detailed accident reconstructions as well as the medical data about how the involved people were injured and treated. In this way, extensive information about a wide range of fields of research such as ''vehicle design for passive and active safety", ''biomechanics", "driver behavior", "trauma medicine", ''rescue services'', ''road design" and ''road conditions" can be collected. Meanwhile a net of in-depth investigation teams are operating worldwide, as NASS (National Accident Sampling System) and CIREN (**C**rash **I**njury **R**esearch and **E**ngineering **N**etwork) in US, OTS (On the spot investigation) in UK.
In Germany the first so-called ''In-Depth Investigation Teams" were initiated in the 1970s by German automakers. In 1973, the Federal Road Research Institute established an independent team at the Medical University of Hanover (in cooperation with the Technical University of Berlin). By 1984, this developed into a long term on-scene accident research study described by Otte [1], based in a defined geographical area surrounding and including Hanover, which collected representative

results. As of 1985, a target of 1000 accidents per year was set to form the basis for future evaluations. A statistical sample plan was used for selecting accidents for investigation and extensive information about the various aspects of the pre-accident, collision, and post-accident phases was collected and compiled into a database.

The value of in-depth accident research studies has been recognized internationally and many other countries also have such teams. Since such detailed information is essential for improving the safety of cars, a strong collaboration with automakers developed. This resulted in a joint project between FAT (Forschungsvereinigung Automobiltechnik or Automotive Industry Research Association) and BASt (Bundesanstalt für Straßenwesen or the Federal Road Research Institute) in 1999. In this project, the geographical area was extended and a second team was set up in the Dresden area providing additional cases from a different part of Germany. Both teams Hanover (MUH) and Dresden (TUD) function in the same manner using the same systems, procedures and collecting data in one common database.

DESIGN AND METHODOLOGY OF THE ACCIDENT RESEARCH CENTERS

Geographical area of the research studies

Figure 1 In-depth investigation area Hanover

The geographical area covers both the municipality of the city of Hanover and the surrounding rural areas within a diameter of approximately 80 km. There are 1.2 million residents in this area and the surface area is approximately 2,289 km². 10% is designated as urban.

Figure 2 In-depth investigation area Dresden

The area Dresden includes the city of Dresden as well as parts of the counties within a diameter of approximately 60 km. There are approximately 925,000 residents in the area and the surface area is approximately 2,575 km².

Sample plan and representativity

Accidents involving personal injury are investigated according to a statistical sampling process. In both areas, the respective police, rescue services, and fire department headquarters report all accidents continuously to the research team. The team then selects accidents according to a strict selection process and investigates these cases following detailed procedures contained in a handbook and coding manual. In order to avoid any bias in the database, the data collected in the study is compared to the official accident statistics for the respective areas and weighting factors are calculated annually. This process explains why the data captured by the research teams can be seen as representative for their areas. The following figures (Figure 3, Figure 4, Figure 5) confirm the random procedure and explain the weighting process.

Accidents with Personal Damage
Team Hannover 2000

	documented by team	within area and shift	Germany
total (n)	1105	3163	382949
maximum severity			
minor injuries	74.9%	86.1%	75.8%
severe injuries	22.6%	12.8%	22.4%
fatalities	2.5%	1.1%	1.8%

⇒statistical weighting

Figure 3 Methodology of weighting procedure

Participants of Accidents with Personal Damage
Team Hannover 2000

	documented by team	within area and shift	Germany
total (n)	2137	6494	710654
kind of participation			
car	64.6%	66.5%	62.8%
truck	9.0%	7.8%	9.9%
motorcycle	6.6%	5.5%	9.5%
bicycle	12.5%	13.5%	11.1%
pedestrian	6.6%	6.0%	6.2%
others	0.7%	0.7%	0.5%

$\Rightarrow$ **no statistical weighting**

Figure 4 Methodology of weighting procedure

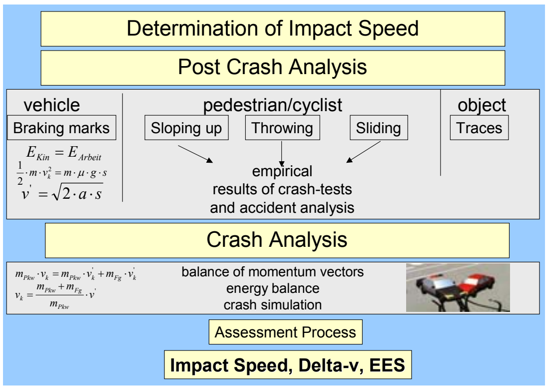

Figure 5 Methodology of reconstruction

It is shown that the investigated cases have the same distribution on traffic participants as the police reported, therefore no weighting of the data is required, but a similar distribution on injury severity with following weighting factors. In total 24 weighting factors have to be considered (Figure 6).

weighting factors

a total of **24** different weighting factors are calculated.

location inside / outside built-up area
shift 0-6 a.m. / 6-12 a.m. / 12-6 p.m. / 6-12 p.m.
injury severity minor / severe / fatal

$$k = \frac{Eg}{Rg} \cdot \frac{Rp}{Ep}$$

weighting factor k
Rg area total per year
Eg documented total per year
Rp area total each sample
Ep documented total each sample

Figure 6 Weighing factors

Statements about the national situation are only possible for those accident features that are relatively independent of regional influences. This is true for the variables which have an effect on the injuries sustained in crashes and therefore the findings from the study can be considered as representative for most aspects of passive safety.

Research studies timing in statistical manner

Accident investigation takes place daily during two six-hour shifts following a 2-week cycle as follows:
First week:
from 00:00 to 06:00 and from 12:00 to 18:00
Second week:
from 06:00 to 12:00 and from 18:00 to 24:00.
This makes it possible to cover all periods of the day throughout the whole year for the random approach.

Accident team structure and special vehicles

During each shift, a team consisting of two technicians, a doctor, and a coordinator is on duty. The coordinator is managing the team by using the sample plan and the defined praxis orientated criteria "last happened accident in time" on the information list of accident events by the police dispatching centers. Each team Hanover and Dresden has two specially equipped vehicles available. These are equipped with flashing blue lights, sirens, special signals and emergency radio equipment. Various cameras and instruments are available for measuring and recording purposes. Accurate scale sketches of the scene of the accident are created using a technique known as "photogrammetry".

Figure 7 Vehicles for in-depth research

Scope of data

Between the two centers, about 2000 accidents are investigated annually. The studies include such information as:

- Environmental conditions
- Road design
- Traffic control
- Accident details and cause of the accident
- Crash information e.g. driving and collision speed, Delta-v and EES, degree of deformation
- Vehicle deformation
- Impact contact points for passengers or pedestrians
- Technical vehicle data

- Information relating to the people involved, such as weight, height etc.

Figure 8 In-depth team on scene

The information collected "on the scene" is complemented by more detailed measurement of the vehicles (usually on the following day), further medical information about injuries and treatment and an extensive accident reconstruction generated from evidence collected at the accident scene.
By applying established physical principles, the impact events are reconstructed (e.g. collision speeds) using proven software such as PC-Crash[1]. The output can be graphically displayed to allow a full understanding of the crash events.

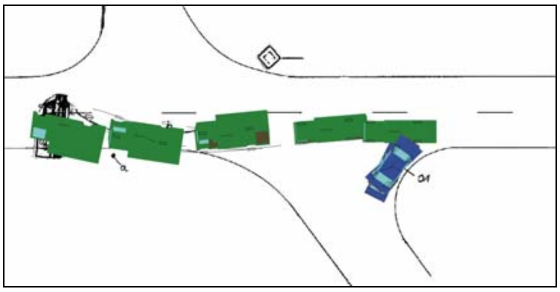

Figure 9 Reconstruction by simulation

Approximately 500 to 3,000 pieces of information per accident are obtained in total. Any personal data included is processed according to data protection regulations. Medical confidentiality and the rights of the individuals are guaranteed. All information is stored anonymously in database produced using SIR (Scientific Information Retrieval) software[2] and is available for evaluation.
Different classification systems are used, i.e. AIS [2], CDC [3], Polytrauma Score [4], and other scores [Otte - 5].

Use of data

The data collected is used in various ways:

- Legislators can study the accident cases in detail to identify and quantify future areas for legislation and to recognize negative developments in advance. The detailed documentation available (eg detailed information about vehicle deformation, causes of injury to passengers and other road users such as pedestrians and cyclists) can form the basis for future legislation. This type of data has served as the basis for developing suitable test methods for type approval (e.g. EU Directives). In this way, research studies conducted by traffic accident researchers has already had an effect on legislation and can be seen as having a positive effect on the accident and casualty situation. Special notice should be given to studies on the effectiveness of safety belts, on the necessity of safety helmet for cyclists, and the protection offered to motorcyclists wearing crash helmets.
- Both the automotive industry and the BASt can compare real accident situations to crash tests. Structures causing injuries can be recognized at an early stage. The statistical data is also used for developing crash test programs, for supporting and validating computer simulations, recognizing and assessing potential areas of future safety developments and evaluating vehicle safety performance in real world accident situations.
- Feedback regarding road traffic engineering (such as assessing the severity of collisions between vehicles and objects at the side of the road) can also be obtained. In terms of impact severity and injury risk, trees are ranked as ''very high'', safety barriers as ''medium'' and free space at the side of the road as ''very low''. Measures can be identified from the data which lead to improved design of roadside objects (e.g. poles, posts, and stakes) such as erecting protective barriers around trees. In addition, statistical data on essential factors (such as speed, mass and angle) serves as the basis for defining standards for impact tests (e.g. EN 1317, ECE).

Integration into international research

Cooperation with research projects in other countries enables the statistical data collected and analyzed to be used for international comparisons and research activities. One example is a European project called "STAIRS" (**St**andardisation of **A**ccident **I**n-Depth **R**esearch **S**tudies) which was completed in 1998. In STAIRS, a standardized method for collecting crash injury data was developed. The recommendations

[1] Steffan Datentechnik, Graz
[2] Scientific Information Retrieval, Sydney

from STAIRS have been implemented into the data collection procedures used by both centres. The data were used for many requests of EEVC groups finding arguments and positions for test conditions, i. e. EEVC WG 17 pedestrian protection.

ANALYSIS OF MULTIPLE COLLISIONS

For the analysis of multiple impact conditions in accidents with cars 3,557 cases are available in GIDAS database. It must be taken into consideration that the database was started in June 1999 and for this study only accidents were available in weighted form up to December 2001. Therefore cases of the investigation Hanover are used mainly for the study that were collected between 1985 and 2000. To be able to analyse accidents with multiple collisions, it is absolutely essential to have knowledge of the entire motion from the beginning of accident event to final position of the vehicle. Thus, only those accidents can be analysed, for which the necessary information is in the database. However, an accident is only reconstructed with respect to accident characteristic parameters, travelling and collision speed, Delta-v und EES after the accident file has been completed. Thus, months can pass before this information reaches the database. This explains why more recent accidents cannot be considered and that for this study, data collected in Hanover on accidents occurring before 1999 were also taken into consideration. These accident files were all in statistically weighted form, which make it possible to provide representative information.

There are 12,030 road accidents for consideration. Of these, 20.9 % are multiple collisions. It is of interest to note that with 1,077 reconstructed cases in GIDAS, the percent of multiple collisions was found to be about the same, namely 21.1 %. This indicates that there is good representation and that the methods used by both teams with in the GIDAS database are analogously.

During an accident, a vehicle can collide with another vehicle, with people and various objects on the side of the road. Most collisions involve other motorised vehicles in 62.2 %, 30.4 % are pedestrians, bicyclists and animals, trees or poles are found in 4.1 %, a ditch or leading pile are also considered as collision objects. Within the framework of the study, collisions with leading piles so called bagatelle collision cause hardly any impact deceleration due to the mostly flexible bending. Also collisions with bicyclists, pedestrians and animals as well as all collisions with delta-v up to 5 km/h should be not considered for this study. With this modified selection criteria 2,217 cars remain with multiple collisions (14.9 %), taking place in the years from 1985 to 2000. GIDAS counts only 186 cars with these criteria for this study. A comparative representation between the Hanover database and the GIDAS data makes no sense because of the small number of cases. The results from the data collected in Hanover are presented in weighted form in this study. If possible, and sensible, statistical methods for calculating significance are used.

STRUCTURE AND SEVERITY OF ACCIDENTS WITH MULTIPLE COLLISIONS

30 % of accidents with multiple collisions take place out side of cities, while 9.2 % of accidents within cities are multiple collisions. Multiple collisions are becoming more and more frequent. During the last years there can be registered a percentual increase annually.

14.9% of all cars in accidents are involved in multiple collisions, related to accidents with physical injuries. While motorised vehicles are often the primary collision partner, trees and poles, walls, ditches, guard rails and especially humps are often recorded as secondary collision objects. The fourth most frequent collision situations as primary collision are happened with trees/poles. There is a relatively analogously distribution in GIDAS. In 1/3 of the cases, after a primary collision with a vehicle (Figure 10), the secondary collision is also with a vehicle. In 9.5 % of the cases, the secondary collision is with a tree and in 6.3 % of the cases with a guard rail. The rank of the 4 most frequent collision configurations, shown in Figure 10, also shows agreement with the small data set of the GIDAS database.

%	total (n)	secondary impact						
		motorised vehicle	tree, pole	wall	ditch, barrier	guardrail	rollover	others
total (n)	2217	838	446	90	200	231	321	91
primary impact:								
mot. vehicle	1378	**37,1**	**9,5**	**3,0**	**3,0**	**6,3**	**3,6**	**2,8**
tree, pole	338	**0,6**	**5,5**	**0,3**	**2,5**	**0,1**	**3,8**	**0,3**
wall	43	**0,2**	**0,3**	**0,6**	**0,2**	**0,2**	**0,5**	**0,1**
ditch, barrier	188	-	**1,2**	**0,2**	**1,7**	-	**4,3**	**0,2**
guardrail	174	**1,7**	**0,6**	**0,2**	**0,4**	**3,3**	**1,1**	**0,3**
rollover	24	**0,1**	**0,5**	**0,1**	**0,1**	**0,1**	**0,1**	-
others	72	**0,6**	**0,7**	**0,2**	**0,2**	**0,1**	**0,6**	**1,0**

Figure 10 Primary and secondary impact for cars with multiple impact (n=2217, delta-v > 5 kmph)

In 84.5 % of cases with multiple collisions there is more than 1 follow-up collision (Figure 11), 12.3 % two secondary collisions, 2.6 % three secondary collisions and 0.5 % four secondary collisions. Within the study, a maximum of 5 follow-up collisions (0.1 %), i.e. accidents with six collisions could be registered.

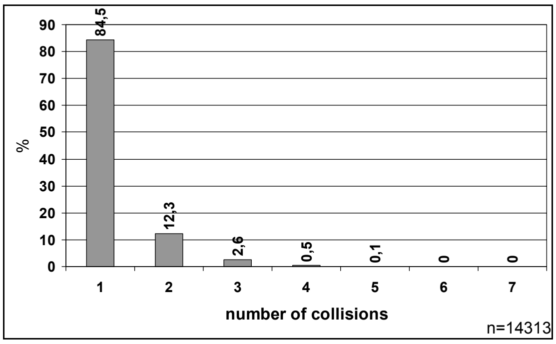

Figure 11 Number of collisions of n=14,313 cars

In comparison with single collision situations, accidents involving multiple collisions are associated with clearly greater severity of injury. Passengers are not injured in 48.7 % of accidents involving single collisions, while only 30.4 % of passengers involving in accidents with multiple collisions are not injured. Especially MAIS 2-4 values are much more frequent in multiple collisions.

The severity of injury also increases with rising number of follow-up collisions. In the case of one single collision 61.9 % of passengers are not injured (Figure 12), 31.5 % suffer minor injuries MAIS 1, 0.5 % suffer serious injuries MAIS 2 to 4, no MAIS 5/6 injuries can be registered here. In contrast in the case of 2 collisions only 22.3 % of passengers remain free of injury and 16 % suffer severe injuries with MAIS 2 to 4, 1.3 % MAIS 5/6.

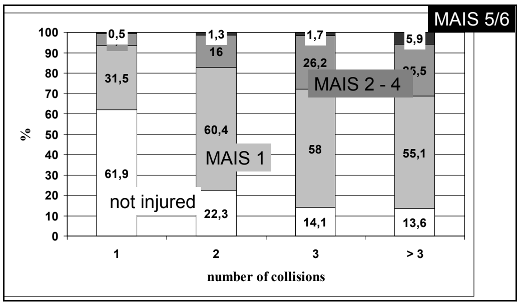

Figure 12 Maximum injury severity of occupants (n=14,313 cars)

Accidents involving multiple collisions take place mostly on motorways. Here, the proportion is 42.7 % (Figure 13). The percent of seriously injured passengers (MAIS3+) is 6%. Iced roads (28.5 %) seem to be a special risk for multiple collisions.

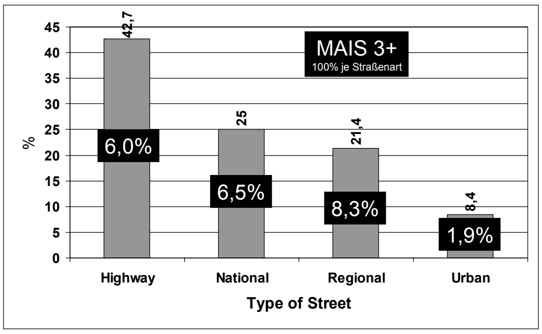

Figure 13 Frequency of multiple collisions (Delta-v > 5 kmph)

The major objects within multiple collisions are found as motorised vehicles, especially as primary collision partner (Figure 14).

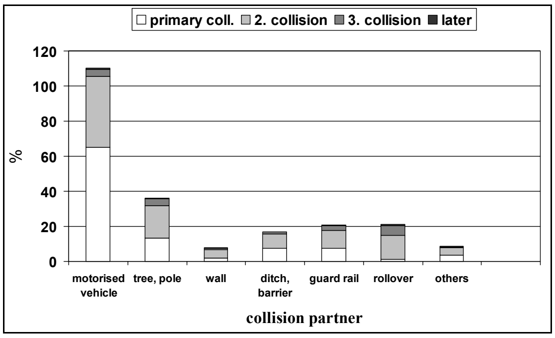

Figure 14 Cars with multiple impacts (n=2217 Delta-v > 5 kmph)

In multiple collisions, drivers are not injured so seriously than other front passengers, 31.7% remain uninjured. In contrast, 18.1 % of front passengers are uninjured (Figure 15). Passengers on rear seats suffer injuries more often in multiple collisions, for example 28 % of passengers on the middle rear seats suffered MAIS 2+ injuries in multiple collision accidents, while to this in only 2.5 % the middle seat was occupied in all crashes.

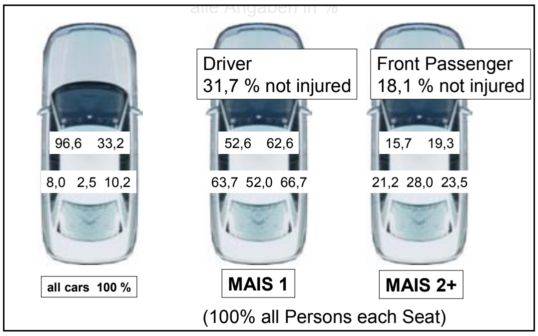

Figure 15 Cars with multiple collisions, seat occupation and injury severity

In multiple collision accidents almost all body regions are injured frequently (Figure 16). The upper extremity is especially involved. In compared to single collision accidents, passengers suffer injuries in this region twice as often during multiple collision accidents. In contrast, injuries to the neck occur less often during multiple collision accidents (6.3 %) compared with single-collision accidents (19.8 %). This can possibly be attributed to the special characteristics of so-called „whiplash“ injuries, which are especially observed in minor accidents, clinically diagnosed on the basis of information from patients and for these special findings nothing more can be determined in the case of severe traumas.

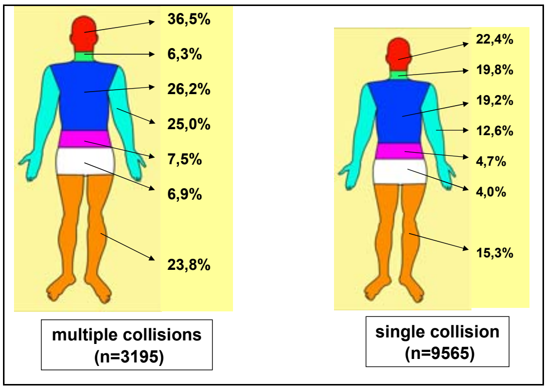

Figure 16 Frequency of injured body regions of occupants

In comparison with single collision accidents, in multiple collisions accidents with cars, many vehicle parts are deformed. For example, in 70.9 % of accidents, the front is involved, the side in 58.4 % of cases and the rear in 36.9 % of cases. The most frequent collision configurations are in 18.9 % primary rear impact following by secondary front impact and in 11.0 % firstly front impact and secondly front impact.

	primary impact				
	front	right	rear	left	others
secondary impact					
front	11,0	4,9	18,9	7,1	0,8
right	6,1	3,4	1,2	3,8	0,4
rear	6,0	1,5	1,0	2,5	0,1
left	6,4	3,8	1,2	4,8	0,2
others	7,5	3,0	0,9	2,7	0,8

Figure 17 Deformed vehicle parts in multiple collisions

The higher severity of accident in multiple collisions is apparently the result of greater travelling speed, among others. In 42.7 % of multiple collision accidents speed greater than 70 km/h was determined, while this was the case in 22.9 % of single-collision accidents. In contrast the distribution of the severity of accident in the form of collision related speed change delta –v for single collision accidents did not differ considerably significantly from that associated with multiple collision accidents, 81 % had delta-v values up 30 km/h in multiple collisions compared with 87.5 in single collision accidents (Figure 18).

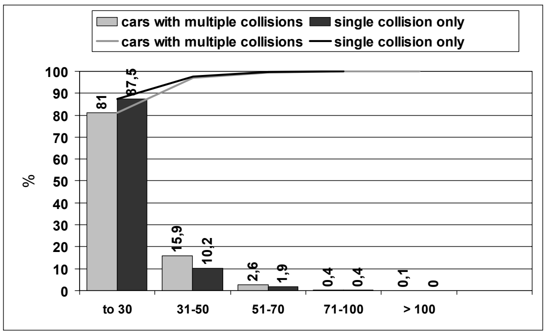

Figure 18 Delta-v for primary collision (< 5 kmph are not included)

Within the framework of this study, the maximum delta-v of the follow-up collision was determined (Figure 19). Here in 89.8 % of cases there was a severity of accident to 30 km/h, 8.7 % at 31 – 50 km/h and in only 1.5 % delta –v value above 50 km/h.

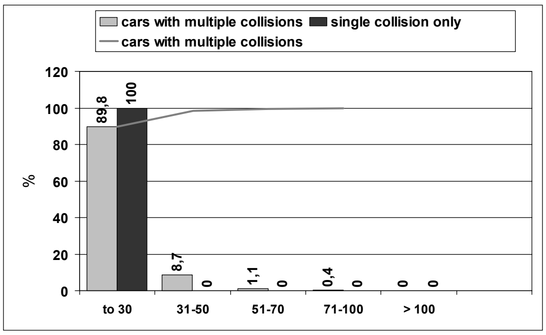

Figure 19 Maximum delta-v for follow-up collisions (delta-v > 5 kmph)

CHARACTERISTICS OF MULTIPLE COLLISIONS

To be able to provide more information about the characteristics of multiple collisions, collision types were formed and these were analysed comparatively between primary and secondary collision. To determine the collision types, the time sequence of collision partners between primary and secondary collision was plotted in the form of a cross table and the 6 most frequent observations were emphasized. Furthermore the most severe types were analysed and described too.

It can be seen that a collision with an object influences the severity of injury. Also the collision site on vehicles shows a different order within the collision types.

The most happened types of multiple collisions are:

- frontal impact against tree/pole 17.8 %
- frontal impact to rear end of car 17.7%
- head on collision car to car 14.8 %

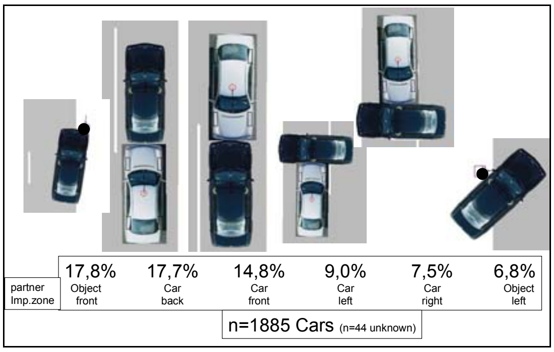

Figure 20 Frequent collision types of severest collisions

In contrast the most severe types with seriously injured (MAIS 3+) are (Figure 21):

- Primary collision of car front to an object - secondary collision of car left to an object 6.5 %
- Primary collision of car front to an object - secondary collision of car front to an object: 6.1 %

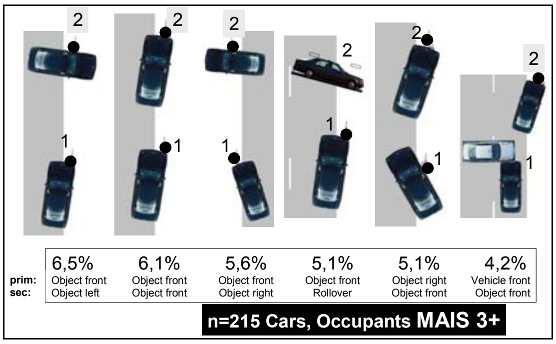

Figure 21 Frequent collision types of multiple collisions

With 13.7 %, the most frequent collision configuration is the primary collision in the framework of a rear-end collision and a secondary collision with the vehicle front (Figure 22). The second most frequent collision configuration (5.8 %) is the primary collision of an object to the front of vehicles with secondary rollover, with 4.3 %, the collision between two vehicles with participation of the front and a subsequent object.

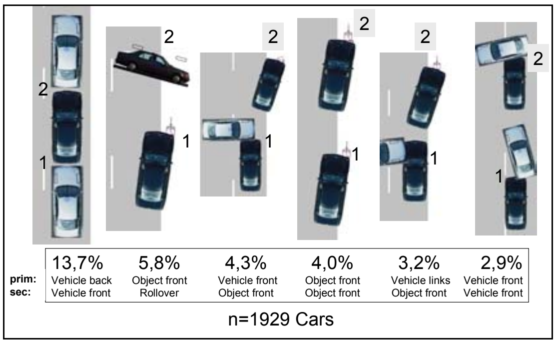

Figure 22 Frequent collision types of primary and secondary impact

It was possible to determine the collisions with the most severe consequences for passengers within the framework of this study by viewing those collisions, in which injuries occurred with the greatest individual AIS (Figure 23). In ¾ of all cases, the first subsequent collision was associated with the most severe consequences, the second secondary collision in 17.2 % of cases, and the third secondary collision in 5.5 % of cases.

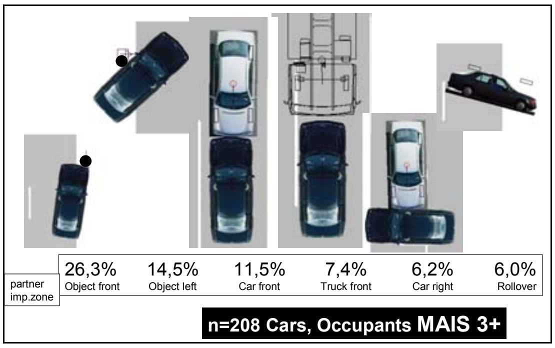

Figure 23 Frequent collision types of severest collision, distinguished between partner and impact zone of car

Especially object collisions were associated with collisions with the most severe consequences. For example, 26.3 % of accidents with MAIS 3+ injured occupants are configurations in which the front is impacting an object, in 14.5 % of cases, the left side of vehicles impacted an object and in 11.5 % of these collisions there is a head on collision of vehicles (Figure 24). Also the four most frequent collision types are characterised by object collisions. After the primary collision, the frontal part, which dominates among the four most frequent impact areas, within the framework of the secondary collision, an collision with an object (side and front) follows with subsequent rollover.

	Impact Zone at Car				
	Front	Right	Back	Left	others
Collision Partner					
Car	**11,5**	**6,2**	**1,5**	**3,2**	**-**
Truck	**7,4**	**1,6**	**0,3**	**5,3**	**0,4**
Object	**26,3**	**11,3**	**1,9**	**14,5**	**1,6**
Rollover	**-**	**-**	**-**	**-**	**6,0**
others	**-**	**0,6**	**-**	**0,6**	**-**

Figure 24 Severest collision of n=208 cars with MAIS 3+

The time between primary and secondary collisions is often longer than 0.5 s. In only 3.9 % of cases were more than 4 s calculated (Figure 25). Especially in cases with severe injuries is this time period longer, i.e. in 7.9 % of accidents it is longer than 4 s and based on the fact that the car collides with a tree, rolls over and then usually collides with another tree at a distance of more than 5 metres.

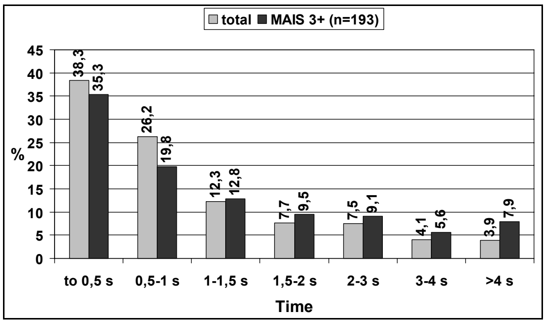

Figure 25 Time between primary and secondary collision

CONCLUSIONS

In-depth Investigations are always necessary for assessing detailed information of traffic accidents that are not available from the usual statistics of traffic accidents which based on police protocols. Therefore special teams trained in medicine and technical sciences document the accident incident at the site of the accident immediately after the accident.

Meanwhile many teams were implemented round the world, i.e. NASS (National Accident Sampling System) and CIREN (Crash Injury Research and Engineering Network) in US, OTS (On the Spot-investigation) in UK and GIDAS (German In-Depth Accident Study) in Germany working for the same task of detail accident analysis, but working with different approaches and different methodology.
The working method of in-depth investigation can be differ between on scene, on scene in time and retrospective depending on the fact, when the team arrives the scene of the accident. There are advantages and disadvantages of an investigation on scene in time, but such team is able to collect traces parallel and independently of the police work. It is possible to prepare a true to scale drawing for the basis of a technical reconstruction and determination of collision speed. With such basis a reconstruction of vehicle movement can be started and the determination of collision and driving speed can be carried out in quality, i.e. in a pedestrian accident there is a possibility to determine the speed of the car via braking marks of the vehicle, but if no collision point on the road does exist, the calculation can be possible out other issues on the road, i.e. out of the throwing and sliding distances of the pedestrian and cyclist to the rest or the position of the glass field on the road surface.

A second priority of in-depth investigation approach is the assessment of motion trajectories of bodies inside and outside the vehicles. The known kinematics from dummy studies can be compare to the finding impact points of the human body in real accidents pointed out the primary and secondary impact conditions. The database of such teams should register the analysed injury causation parts.
Injuries are the result of a mechanical load to the human body that exceed the load to the biological system. That biological system is divided into soft tissue, bony and ligamentory structures registered together with the injury severity based on AIS scaling. With the data of the technical survey, i. e. EES and Delta-v the border of injury load level can be pointed out. There are many points describing the benefit of in-depth investigation approach. The shown example of the analysis of multiple impact conditions in current traffic accidents has given the major impact configurations which are responsible for severe injuries of car occupants. With this knowledge an optimised research on engineering and scientist level can be started to make cars safer.
Regarding the small radius of action of such in-depth-investigation team a very limited number of cases can be collected in a limited area of a country. Therefore a statistical sampling plan has to be defined for the approach of representative on one hand and a wide implementation of teams nationwide has to be implemented on the other hand. GIDAS (German In-Depth Accident Study) is one tool in the international In-Depth investigation structure. Nevertheless many of current traffic safety aspects are dealed internationally, therefore such teams should be implemented in many countries worldwide. The demands for an exchange of data and experiences do exist, methods of data sampling and reconstruction procedures have to be concentrated internationally and a network of in-depth investigation centres have to be founded.

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